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EXAMINER	
HSU, JONI	

ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/729,684	HONG ET AL.	
	Examiner	Art Unit	
	Joni Hsu	2628	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 23 August 2007.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1,3-10,12-23,25 and 26 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1,3-10,12-23,25 and 26 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed August 23, 2007 are fully considered but are not persuasive.

2. Applicant argues z-pyramid of Voorhies (US007023437B1) is not equivalent to compressed z-buffer claimed (pages 13-14).

In reply, Examiner disagrees. Voorhies teaches z-pyramid data structure is hierarchical z-buffer that is compressed (c. 33, ll. 36-39; c. 55, ll. 66-67), and so is considered to be equivalent to compressed z-buffer.

3. Applicant argues that Voorhies fails to teach performing a two-level z-test on graphic data as recited in Claim 1. "Levels" disclosed in Voorhies relate to different levels in a z-pyramid. Voorhies teaches that "since a z-pyramid has a plurality of levels which are each a depth buffer, it can also be described as a hierarchical depth buffer." In contrast, the term "level" recited in claim 1 relates to differing levels of a z-test. The second level of the z-test depends in part on the outcome of the first level z-test. Voorhies fails to teach this feature (p. 14-15).

In reply, the Examiner points out Fig. 11 in Voorhies shows flowchart of z-test, and shows z-test (1114) is first performed on one level, and if that level is not the finest level (1118), the z-test process loops back to the beginning and repeats the z-testing process for the next finest level, and the z-test continues to proceed to another level until the finest level is reached (c. 16, ll. 1-22). The second level of the z-test depends in part on the outcome of the first level z-test (*coarse rasterizer processes tiles at 16x16 pixel region, such processing includes z-value culling, coarse rasterizer sends an output of such processing to the normal rasterizer which processes*

tiles at a finer size (4x4 pixel region), normal rasterizer performs the z-value culling on the tiles at the finer level, c. 54, ll. 44-55). So, Voorhies teaches differing levels of a z-test.

Claim Rejections - 35 USC § 102

4. The text of those sections of Title 35, U.S. Code 102(e) not included in this action can be found in a prior Office action.

5. Claims 1, 4, 5, 7-9, 13-15, 17, 19-21, 23, 25, and 26 are rejected under 35 U.S.C. 102(e) as being anticipated by Voorhies (US007023437B1).

6. As per Claim 1, Voorhies teaches multi-pass method of rendering plurality of graphic primitives (c. 2, ll. 58-67; c. 6, ll. 28-29) comprising in first pass: passing only limited portion of graphic data for each primitive through graphic pipeline, limited portion of graphic data has location-related data (c. 3, ll. 16-31). According to Applicant's disclosure, compressed z-buffer effectively provides condensed depth information for multiple pixels, such that grouping of pixels (or macro-pixel) may by trivially accepted if all pixels of current macro-pixel are deemed to be in front of previously-stored pixels or trivially rejected if all pixels of current macro-pixel primitive are deemed to be behind previously-stored pixels [0023]. Voorhies teaches macro-pixel (16x16 pixel region) may be trivially accepted if all pixels of current macro-pixel are deemed to be in front of previously-stored pixels or trivially rejected if all pixels of current macro-pixel primitive are deemed to be behind previously-stored pixels (c. 54, ll. 44-55; c. 6, ll. 1-14). Z-pyramid data structure is hierarchical z-buffer that is compressed (c. 33, ll. 36-39; c. 55, ll. 66-67), and so is a compressed z-buffer. So, Voorhies teaches processing limited portion of graphic data to build compressed z-buffer, compressed z-buffer having plurality of z-records, each z-record embodying z information for plurality of pixels (c. 54, ll. 44-55; c. 6, ll. 1-14). Record for

each fragment includes coverage mask indicating image samples covered by fragment, and this record format is designed to resolve visibility at each image sample (c. 33, ll. 42-49). So bits on coverage mask are set to indicate whether image samples in primitive are visible or not, and this is considered to be setting visibility indicator, for each primitive, if any pixel of primitive is determined to be visible. In a second pass: for each primitive, determining whether associated visibility indicator for that primitive is set; discarding, without passing through graphic pipeline, primitives for which associated visibility indicator is not set; passing remaining portion of graphic data for each primitive determined to have associated visibility indicator set (c. 54, ll. 44-55; c. 46, ll. 61-c. 47, ll. 4; c. 3, ll. 16-35). Multi-level z test is performed, and test continues to proceed to another level until finest level is reached (c. 16, ll. 1-22). Fig. 11 in Voorhies shows flowchart of z-test, and shows z-test (1114) is first performed on one level, and if that level is not the finest level (1118), z-test process loops back to the beginning and repeats z-testing process for next finest level, and z-test continues to proceed to another level until finest level is reached (c. 16, ll. 1-22). Second level of z-test depends in part on outcome of first level z-test (c. 54, ll. 44-55). So, Voorhies teaches performing two-level z test on graphic data, wherein first level of z-test compares graphic data of current primitive with corresponding information in compressed z-buffer, and second level of z-test is performed on per-pixel basis in z-test manner, wherein second level z-test is performed only on pixels within record of compressed z-information in which first level z-test determines some but not all pixels of associated macropixel are visible (c. 54, ll. 44-55; c. 6, ll. 39-43; c. 16, ll. 1-22). Visible geometry is rendered (c. 5, ll. 50-53), rendering includes shading (c. 6, ll. 15-17). So Voorhies teaches communicating data associated with pixels of macropixels determined to be visible to pixel shader for rendering.

7. As per Claim 4, Voorhies teaches each compressed z-record (c. 54, ll. 44-55) has minimum z value for pixels, maximum z values for pixels (c. 8, ll. 43-55), and coverage mask indicating which of the pixels are visible for current primitive (c. 33, ll. 42-47; c. 6, ll. 28-29).

8. As per Claim 5, Voorhies teaches each compressed z-record (c. 54, ll. 44-55) has 2 minimum z values for pixels, 2 maximum z values for pixels (c. 8, ll. 43-55), coverage mask indicating which pixels are visible for current primitive (c. 33, ll. 42-47; c. 6, ll. 28-29).

9. As per Claim 7, parser is known in the art to be component of compiler that forms data structure, usually a tree, that is suitable for later processing and captures implied hierarchy of input. Voorhies teaches parser forms tree data structure that is suitable for later processing and captures hierarchy of input (c. 9, ll. 57-61), discarding is performed by parser (c. 54, ll. 44-55).

10. As per Claim 8, Voorhies teaches rendering plurality of graphic primitives comprising passing, within graphic pipeline, only limited portion of graphic data associated with each primitive, limited portion of graphic data has location-related data (c. 2, ll. 58-67; c. 6, ll. 28-29; c. 3, ll. 16-31); each primitive comprises plurality of pixels (c. 6, ll. 40-44, c. 6, ll. 66-67-c. 7, ll. 3); processing limited portion of graphic data associated with each individual primitive to build compressed z-buffer for each primitive, each z-buffer has compressed z-information for a macro-pixel; determining, for each primitive, whether primitive has at least one visible pixel; communicating data associated with pixels of primitives determined to have at least one visible primitive to pixel shader for rendering; passing, processing, within pixel shader, remaining graphic data associated with each primitive only for those primitives determined to have at least one visible pixel, wherein remaining graphic data includes at least one of the following: lighting,

texture, fog data (c. 54, ll. 44-55; c. 6, ll. 1-17, 39-43; c. 16, ll. 1-22; c. 3, ll. 16-35; c. 5, ll. 50-53; c. 33, ll. 36-39; c. 55, ll. 66-67)..

11. As per Claim 9, Voorhies teaches setting visibility indicator for each pixel determined to have at least one visible pixel (c. 33, ll. 42-49).

12. As per Claim 13, Voorhies teaches method of rendering plurality of graphic primitives (c. 2, ll. 58-67; c. 6, ll. 28-29) comprising passing in first pass, within graphic pipeline, only limited portion of graphic data for each primitive, each primitive has plurality of pixels and wherein limited portion of graphic data has location-related data (c. 3, ll. 16-31; c. 6, ll. 40-44, c. 6, ll. 66-67-c. 7, ll. 3); processing limited portion of graphic data to build compressed z-buffer, compressed z-buffer having plurality of z-records, each z-record embodying z information for plurality of pixels (c. 54, ll. 44-55; c. 6, ll. 1-14; c. 33, ll. 36-39; c. 55, ll. 66-67); in second pass, within graphic pipeline, performing two-level z-test on graphic data, wherein first level of z-test compares graphic data of current primitive with corresponding information in compressed z-buffer, and wherein second level of z-test is performed on per-pixel basis in z-test manner, second level z-test is performed only on pixels within record of compressed z-information in which first level z-test determines some but not all pixels of macropixel (16x16 pixel region) are visible, additional graphic data associated with each primitive is passed into graphics pipeline on second pass only for primitives that are at least partially visible (c. 54, ll. 44-55; c. 6, ll. 39-43; c. 16, ll. 1-22; c. 3, ll. 16-35, Fig. 11); and communicating data associated with pixels of macropixels determined to be visible to pixel shader for rendering (c. 5, ll. 50-53; c. 6, ll. 15-17).

13. As per Claim 14, Voorhies teaches graphics processor having 1st-pass logic that delivers to graphic pipeline, in 1st pass, only limited portion of graphic data for each primitive, each

primitive has plurality of pixels, limited portion of graphic data has location-related data (c. 3, ll. 16-31; c. 6, ll. 40-44, c. 6, ll. 66-67-c. 7, ll. 3); logic that processes limited portion of graphic data for each primitive to create compressed z-buffer having a plurality of z-records, z-information for macro-block is compressed into each of the plurality of z-records (c. 54, ll. 44-55; c. 6, ll. 1-14; c. 33, ll. 36-39; c. 55, ll. 66-67); logic that determines, for each primitive, whether primitive has at least one visible pixel (c. 54, ll. 44-55; c. 6, ll. 1-14); 2nd-pass logic that delivers to graphic pipeline, in 2nd pass, remaining graphic data associated with each primitive for only those primitives determined to have at least one visible pixel, 2nd-pass logic configured to inhibit delivery of graphic data to graphic pipeline for primitives not determined to have at least one visible pixel (c. 54, ll. 44-55; c. 6, ll. 39-43; c. 16, ll. 1-22; c. 3, ll. 16-35).

14. As per Claim 15, a parser is known in the art to be a component of a compiler that forms a data structure, usually a tree, which is suitable for later processing and which captures the implied hierarchy of the input. Voorhies discloses a parser that forms a tree data structure which is suitable for later processing and which captures the hierarchy of the input (c. 9, ll. 57-61), and the first-pass logic and a second-pass logic are contained within a parser (c. 54, ll. 44-55).

15. As per Claim 17, Voorhies discloses including logic for setting a visibility indicator for each primitive determined to have at least one visible pixel (c. 33, ll. 42-49).

16. As per Claim 19, Voorhies teaches including logic configured to associate each primitive processed in the first pass of the data with a distinct visibility indicator (c. 33, ll. 42-49).

17. As per Claim 20, Voorhies discloses including logic configured to evaluate, for each primitive presented for processing in the second pass, a status of the visibility indicator associated with the given primitive (c. 54, ll. 44-55; c. 46, ll. 61-c. 47, ll. 4).

18. As per Claim 21, Voorhies teaches graphics processor having logic that passes and processes only portion of graphic data passed into graphic pipeline for each of plurality of primitives, in 1st pass within graphic pipeline to determine whether primitive has at least one visible pixel, wherein each primitive comprises plurality of pixels, and graphic data has location-related data (c. 3, ll. 16-31; c. 6, ll. 1-14, 40-44, c. 6, ll. 66-67-c. 7, ll. 3; c. 54, ll. 44-55); logic building compressed z-buffer from processing of the graphic data in the first pass, z-buffer comprising a plurality of z-records, z-information for a macro-block is compressed into a single record (c. 54, ll. 44-55; c. 6, ll. 1-14; c. 33, ll. 36-39; c. 55, ll. 66-67); and logic that renders, in 2nd pass within graphic pipeline, only primitives determined in 1st pass to have at least one visible pixel, remaining portion of graphic data associated with each primitive is passed into graphics pipeline on 2nd pass (c. 54, ll. 44-55; c. 6, ll. 39-43; c. 16, ll. 1-22; c. 3, ll. 16-35).

19. As per Claim 23, a parser is known in the art to be a component of a compiler that forms a data structure, usually a tree, which is suitable for later processing and which captures the implied hierarchy of the input. Voorhies discloses a parser that forms a tree data structure which is suitable for later processing and which captures the hierarchy of the input (c. 9, ll. 57-61), and the logic configured to limit the processing of graphic data is within a parser (c. 54, ll. 44-55).

20. As per Claim 25, Voorhies discloses including logic for setting a visibility indicator for each primitive processed in the first pass (c. 33, ll. 42-49).

21. As per Claim 26, Voorhies teaches logic evaluating visibility indicator for each primitive prior to submitting primitive to logic rendering in 2nd pass (c. 54, ll. 44-55; c. 46, ll. 61-c. 47, ll. 4).

22. Thus, it reasonably appears that Voorhies describes or discloses every element of Claims 1, 4, 5, 7-9, 13-15, 17, 19-21, 23, 25, and 26 and therefore anticipates the claims subject.

Claim Rejections - 35 USC § 103

23. The text of those sections of Title 35, U.S. Code 103(a) not included in this action can be found in a prior Office action.

24. Claims 3, 6, 10, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Voorhies (US007023437B1) in view of Gannett (US006118452A).

25. As per Claim 3, Voorhies is relied upon for the teachings as discussed above relative to Claim 1. Voorhies teaches location-related data comprises X, Y, and Z values (c. 14, ll. 22-38).

However, Voorhies does not teach location-related data has W values. However, Gannett teaches location-related data has X, Y, Z and W values (c. 1, ll. 29-33; c. 13, ll. 50-55).

It would have been obvious to one of ordinary skill in the art at time of invention by applicant to modify Voorhies so location-related data has W values as suggested by Gannett because Gannett teaches W is needed in order to determine horizontal length of pixels to render, and W is commonly used in typical computer graphics systems (c. 1, ll. 18-33; c. 13, ll. 50-55).

26. As per Claims 6, 10, and 18, Voorhies does not teach setting visibility indicator is setting bit in frame buffer memory. However, Gannett teaches setting visibility indicator comprises setting bit in frame buffer memory (c. 13, ll. 16-19; c. 14, ll. 13-22).

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to modify device of Voorhies so setting visibility indicator more specifically comprises setting bit in frame buffer memory as suggested by Gannett because Gannett suggests setting bits in mask is a quick and efficient way to indicate visibility (c. 13, ll. 16-19; c. 14, ll. 13-22).

27. Claims 12, 16, and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Voorhies (US007023437B1) in view of Griffin (US005990904A).

Voorhies is relied upon for the teachings as discussed relative to Claim 8. Voorhies teaches determining whether primitive has at least one visible pixel ensures primitive does not fail compressed z-buffer test (c. 54, ll. 44-55; c. 6, ll. 1-14), ensures all pixels of primitive are not culled (c. 3, ll. 49-55), and ensures all pixels of primitive are not clipped (c. 12, ll. 37-42).

However, Voorhies does not teach ensuring primitive does not render to zero pixels. According to Applicant's disclosure, zero-pixel primitive is primitive that, when rendered, consumes less area than one pixel of visibility [0024]. Griffin teaches compressed z-buffer (c. 9, ll. 34-54), ensuring primitive does not render to zero pixels (c. 2, ll. 61-c. 3, ll. 5; c. 5, ll. 26-42).

It would have been obvious to one of ordinary skill in the art at time of invention by applicant to modify Voorhies to include ensuring primitive does not render to zero pixels as suggested by Griffin because Griffin teaches being able to perform anti-aliasing so anomalies such as jaggy edges in rendered image do not result (c. 2, ll. 61-c. 3, ll. 5). It would be obvious to include compressed z-buffer because Griffin teaches considerably reducing amount of data required, allowing implementation of more sophisticated anti-aliasing algorithm (c. 9, ll. 34-54).

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO

MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joni Hsu whose telephone number is 571-272-7785. The examiner can normally be reached on M-F 8am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on 571-272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JH

KEE M. TUNG
SUPERVISORY PATENT EXAMINER